

ABSOLUTE BINARY PROGRAM NO. 12740-16001  
DATE CODE 1926

# **FLOATING POINT PROCESSOR/ SCIENTIFIC INSTRUCTION SET/ FAST FORTRAN PROCESSOR DIAGNOSTIC**

## **reference manual**

For HP 1000 F-Series Computers



---

HEWLETT-PACKARD COMPANY  
11000 WOLFE ROAD, CUPERTINO, CALIFORNIA, 95014

NOTICE

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard.

This document contains propriety information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced or translated to another program language without the prior consent of Hewlett-Packard Company.

Copyright 1979 by HEWLETT-PACKARD COMPANY

Library Index Number
12740.070.12740-90004

## Table of Contents

### Section I

#### INTRODUCTION

1-1	GENERAL . . . . .	1-1
1-2	REQUIRED HARDWARE . . . . .	1-1
1-3	REQUIRED SOFTWARE . . . . .	1-2

### Section II

#### PROGRAM ORGANIZATION

2-1	ORGANIZATION . . . . .	2-1
2-2	TEST CONTROL AND EXECUTION . . . . .	2-2
2-3	TEST SELECTION . . . . .	2-2
2-4	MESSAGE REPORTING . . . . .	2-2
2-5	DIAGNOSTIC LIMITATIONS . . . . .	2-3
2-6	EXECUTION TIME . . . . .	2-3

### Section III

#### OPERATING PROCEDURES

3-1	INITIALIZING THE DIAGNOSTIC . . . . .	3-1
3-2	RUNNING THE DIAGNOSTIC . . . . .	3-4
3-3	RESTARTING THE DIAGNOSTIC . . . . .	3-4
3-4	TEST SELECTION BY OPERATOR . . . . .	3-5
3-5	PASS MODE SELECTION . . . . .	3-6
3-6	ERROR INFORMATION . . . . .	3-6

### Section IV

#### TEST DESCRIPTIONS

4-1	GENERAL . . . . .	4-1
4-2	BASIC CONTROL TESTS . . . . .	4-1
4-3	TST00 . . . . .	4-1
4-4	TST01 . . . . .	4-2
4-5	TST02 . . . . .	4-2
4-6	TST03 . . . . .	4-2
4-7	TST04 . . . . .	4-2
4-8	TST05 . . . . .	4-2
4-9	TST06 . . . . .	4-2
4-10	TST07 . . . . .	4-3
4-11	TST08 . . . . .	4-3
4-12	TST09 . . . . .	4-3
4-13	TST10 . . . . .	4-3
4-14	TST11 . . . . .	4-3
4-15	TST12 . . . . .	4-3
4-16	TST13 . . . . .	4-4
4-17	TST14 . . . . .	4-4

### Section V

#### DIAGNOSTIC MESSAGES AND HALT CODES

5-1	ERROR FORMATS . . . . .	5-1
5-2	ABNORMAL ERRORS . . . . .	5-1



!-----+-----!	!-----+-----!
! INTRODUCTION	! SECTION I
!-----+-----!	!-----+-----!

## 1-1 GENERAL

The Floating Point Processor/ Scientific Instruction Set/ Fast FORTRAN Processor Diagnostic consists of tests to verify correct operation of the Floating Point Processor (FPP), the standard FPP firmware instructions (part of the Base Set instructions), the Scientific Instruction Set (SIS) firmware, and the Fast FORTRAN Processor (FPP) firmware. These tests include 2, 3, 4, and 5 word add, subtract, multiply, and divide operations; accumulator operations; tests for the SIS firmware routines:

ALOG	COS	SQRT	.FPWR	/CMRT
ALOGT	EXP	TAN	.TPWR	DPOLY
ATAN	SIN	TANH	/ATLG	

and the FPP routines:

DBLE	.CFER	.DDI	.DIN	.DSB	.FLUN	.PWR2	\$SETP
DDINT	.DAD	.DDIR	.DIS	.DSBR	.GOTO	.XCOM	..DCM
SNGL	.DCO	.DDS	.DMP	.ENTP	.NGL	.XFER	..FCM
.BLE	.DDE	.DFER	.DNG	.ENTR	.PACK	.XPACK	..MAP
							..TCM

All diagnostic messages and halts are explained in tables 5-1, 5-2, and 5-3.

## 1-2 REQUIRED HARDWARE

The following hardware is required:

- HP 1000 F-Series Computer (2111F or 2117F) with a minimum of 32K bytes of memory.
- An absolute binary loading device (used to load the Diagnostic Configurator and the diagnostic only).
- A console device for message reporting (optional but recommended).

- d. A standard I/O card other than the system console interface (optional). Required for execution of some tests which require an I/O card to provide interrupts.

### 1-3 REQUIRED SOFTWARE

The following software is required to test the Floating Point Processor, Scientific Instruction Set, and Fast FORTRAN Processor:

- a. Diagnostic Configurator (date code 1627 or later)

Absolute Binary Program no.	24296-60001
Reference Manual part no.	02100-90157

- b. FPP/SIS/FFP Diagnostic

Absolute Binary Program no.	12740-16001
Reference Manual part no.	12740-90004

The diagnostic serial number (DSN) for this diagnostic is 101121 (octal) and is in memory location 126 of the program.

!-----+-----!	!-----+-----!
! PROGRAM ORGANIZATION	! SECTION II !
!-----+-----!	!-----+-----!

## 2-1 ORGANIZATION

The diagnostic program consists of fifteen tests plus the initialization and control sections. The initialization and control sections configure the diagnostic and accept operator selected options in addition to verifying correct microcode operation and basic CPU to FPP interaction. The tests are executed by the control section as sequential or selectable subroutines. The individual tests are:

Basic Control Tests	TSTBC
Floating Point to Single Integer Conversion	TST00
Floating Point to Double Integer Conversion	TST01
Single Integer to Floating Point Conversion	TST02
Double Integer to Floating Point Conversion	TST03
Floating Point Add	TST04
Floating Point Subtract	TST05
Floating Point Multiply	TST06
Floating Point Divide	TST07
Accumulator Operations	TST08
Scientific Instruction Set (part 1)	TST09
Scientific Instruction Set (part 2)	TST10
Scientific Instruction Set (part 3)	TST11*
Fast FORTRAN Processor (part 1)	TST12
Fast FORTRAN Processor (part 2)	TST13
Fast FORTRAN Processor (part 3)	TST14*

\* NOTE SIS part 3 (TST11) and FFP part 3 (TST14) are executed only if the installed firmware is a revision level which contains the instructions that are tested in these tests.

## 2-2 TEST CONTROL AND EXECUTION

After configuration the diagnostic outputs the title message:

FPP-SIS-FPP DIAGNOSTIC DSN xxxxxx

to the console device (if present), and then executes the Basic Control Tests, testing for the presence and currency of the firmware modules. Information messages are displayed to report any configuration changes made as a result of this testing. Upon successful completion, a halt 102076 (octal) will be executed if bit 15 of the S-register was set during configuration. The test sections are then executed by default or according to the options selected in the S-register by the operator. The default is TST00 through TST14 if current base set, SIS, and FPP firmware is installed.

The Basic Control Tests are executed only during configuration (i.e. only when the diagnostic is started or restarted). They will not be executed if bit 9 of the S-register is set as a S-register option (test select option).

TST00-TST08 may also be executed in a short pass or long pass mode, as determined by S-register bit 8.

## 2-3 TEST SELECTION

Any specific test or group of tests, except for the Basic Control Tests, may be invoked through the use of bit 9 of the S-register. See section 3-4 for more details.

## 2-4 MESSAGE REPORTING

Error messages are sent to the console (if used) when a failure occurs during the execution of any of the tests. If bit 14 of the S-register is not set, a halt will follow the message (see tables 5-1 and 5-3). Also, at the end of each pass, the number of passes completed is reported.

Non-error messages are also sent to the console, if present. The Basic Control Tests display a message for each subtest to indicate the next class of operation. Each of the standard tests displays a message indicating the test that is being executed. A message is also displayed whenever a mode change is made between short and long passes or vice versa (see table 5-2).



## 2-5 DIAGNOSTIC LIMITATIONS

The diagnostic cannot verify errors due to improper installation or failure of the FPP, SIS, or FPP ROM modules which cause the CPU to improperly return to the wrong location in memory, or to not return at all. It is therefore recommended that the firmware self-test for these modules be executed before running the diagnostic to guard against unpredictable operation.

## 2-6 EXECUTION TIME

One long pass of the diagnostic takes slightly over 5 minutes with high speed memory, while a short pass takes less than 45 seconds.



!	!	!
!	OPERATING PROCEDURES	!
!	!	!
!	!	SECTION III
!	!	!

### 3-1 INITIALIZING THE DIAGNOSTIC

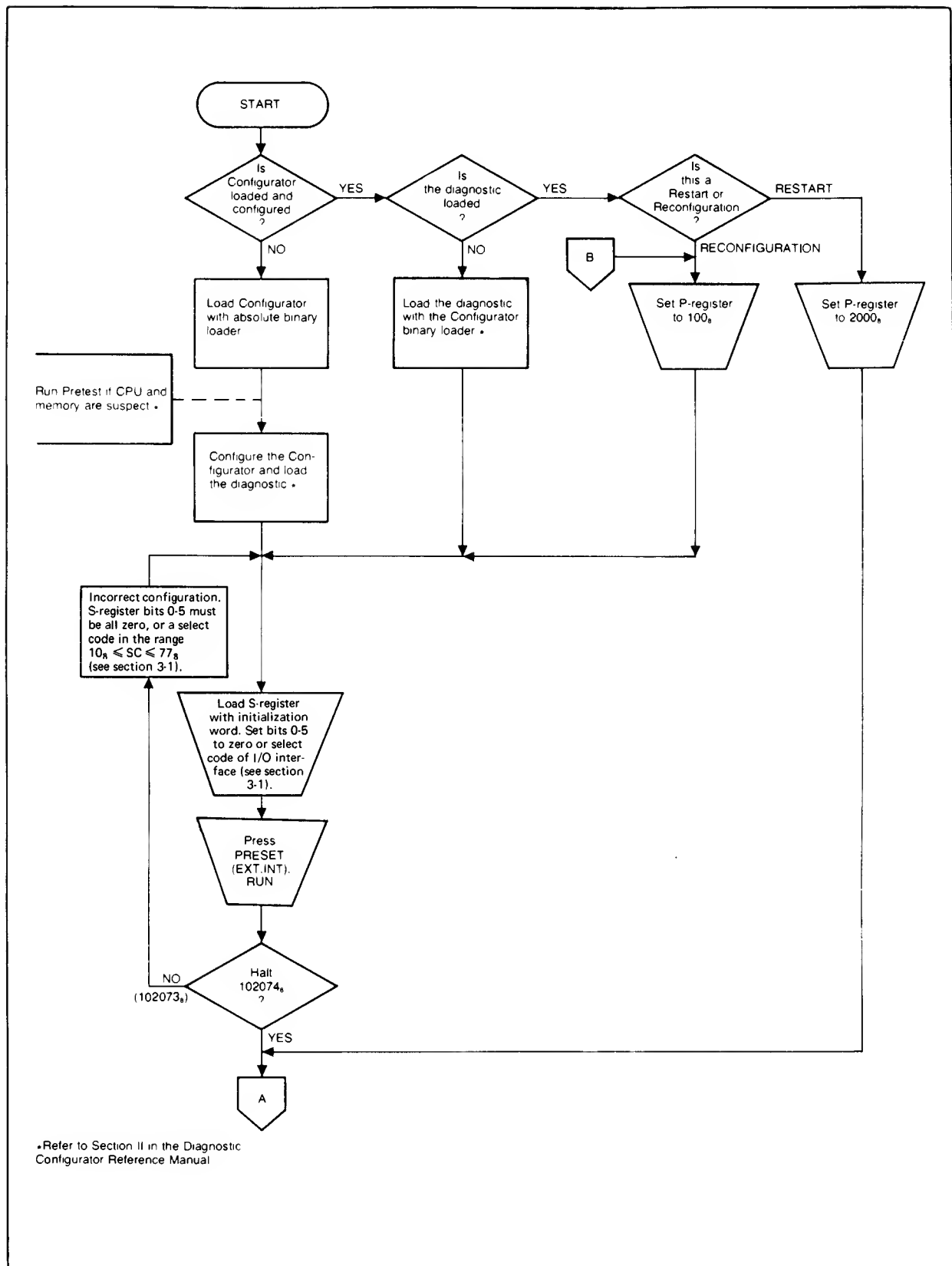
Execution of the diagnostic proceeds in accordance with the options keyed by the operator. Figure 3-1 shows a flowchart of the operating procedure. Additional information may be found in the Diagnostic Configurator Reference Manual.

After the diagnostic is loaded, it must be initialized for proper execution of some of the tests, which require the use of an I/O interface card to provide interrupts. If such an interface is installed and available (do not use the system console interface) the select code of this interface is entered in bits 5-0 of the S-register during configuration (see table 3-1 and flow chart figure 3-1). If no interface is available, bits 5-0 should be set to 0. Bits 15-6 are reserved and should always be set to 0.

Table 3-1. S-register Initialization Settings

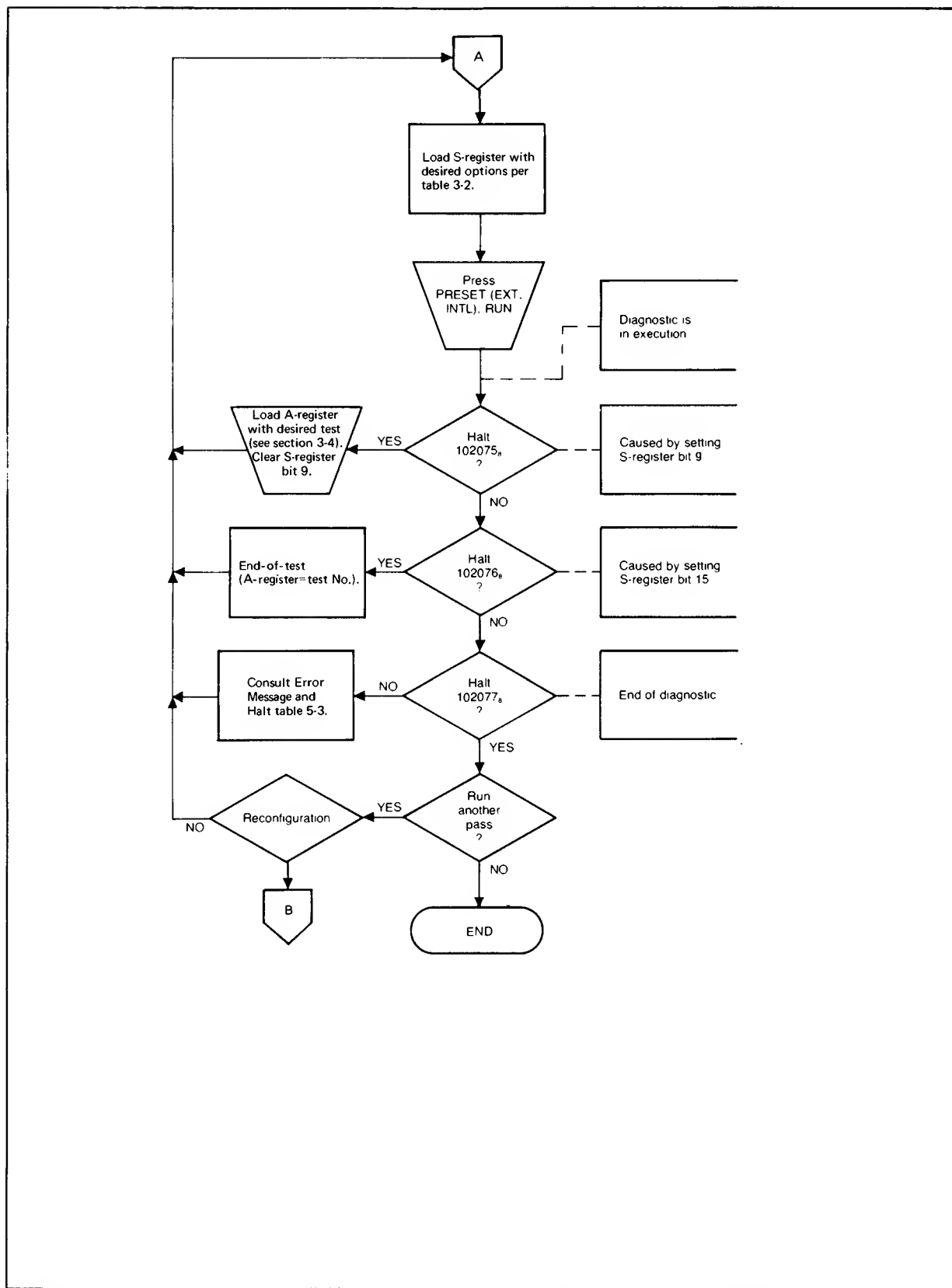
!	!	!
!	S-register	!
!	bits	!
!		Meaning if set
!	!	!
!	5-0	Select Code of standard* I/O card used
!	!	by interruptible tests. If no card,
!	!	input 0 in bits 5-0.
!	!	!
!	15-6	Reserved. All must be 0.
!	!	!

\* A standard I/O card implies that the interface will respond to the assigned meaning of the I/O instructions and will interrupt when the Control and Flag are set, and the interrupt system is enabled (e.g. the HP interfaces 59310, 12665/12771, and 13175/13178 do not use the standard I/O protocol). The I/O card requires no special hood connector, and should not be connected to a peripheral device when executing the tests.



7700 43

Figure 3-1. Operating Procedure Flowchart (sheet 1 of 2)



7700-44

Figure 3-1. Operating Procedure Flowchart (sheet 2 of 2)

### 3-2 RUNNING THE DIAGNOSTIC

A flowchart of the operating procedure is provided in figure 3-1.

After successful initialization (halt 102074 octal displayed in the T-register) the S-register options may be entered (see table 3-2). Initial selection of short or long passes should be made at this time. See section 3-5 for more information.

After configuration, the Basic Control Tests will be executed (unless disabled), and status information reported. In the event that certain firmware routines are not present (older revision of firmware), a message will be displayed indicating that one or more of the tests will not be configured. If the information reported does not agree with that of the installed firmware, the firmware and installation should be checked.

If S-register bit 15 was set and the Basic Control Tests complete successfully, a halt 102076 octal will occur.

If S-register bit 12 is clear, the computer will halt at the completion of each pass with 102077 octal displayed in the T-register, and the pass count in the A-register. To execute another pass of the diagnostic, the operator need only press the RUN switch.

If S-register bit 12 is set, the diagnostic control program will loop continuously on the selected test(s).

### 3-3 RESTARTING THE DIAGNOSTIC

The program may be restarted by setting the P-register to 2000 (octal), selecting the appropriate S-register options found in table 3-2, and pressing RUN. Note that restarting the diagnostic at location 2000 (octal) will not allow the initialization word to be reset.

If a trap cell halt (106077) occurs, the cause of the interrupt should be determined. The program may need to be reloaded before continuing.

Table 3-2. S-regisiter Execution Options

S-register bits	Meaning if set
15	Halt at the end of each test (HALT 102076 octal). A-register contains the octal number of the test just run.
14	Suppress error halts.
13	Repeat last test (loop on one test).
12	Repeat all tests without halting (loop on entire diagnostic).
11	Suppress error messages.
10	Suppress non-error messages.
9	Abort current test (HALT 102075 octal). New tests may be specified in the A-register.
8	Execute in the short pass mode.
7-0	Reserved (all zero).

#### 3-4 TEST SELECTION BY OPERATOR

The control portion of this diagnostic program allows the operator the option of selecting one test or a sequence of tests to be run. Setting S-register bit 9 results in a halt 102075 (octal), at which time the A-register bits are set for the desired test numbers. (Any test currently running is completed before the program halt.) A-register bit 0 corresponds to TST00, bit 1 to TST01, etc. If the A-register is set to zero, all of the tests in the standard configuration are run.

After selecting the desired tests, clear S-register bit 9 and press RUN.

#### NOTE

Execution of tests reported as "not configured" during the basic control tests is not recommended, as results are unpredictable.

### 3-5 PASS MODE SELECTION

Bit 8 of the S-register determines whether short or long passes are executed. The default (bit 8 clear) is long passes, which performs a more rigorous test of the FPP and its related firmware. In the short pass mode the diagnostic executes a restructured subset of the operations used in a long pass mode.

Bit 8 is sampled preceding the execution of each pass, and when operator test selection (bit 9 set) is performed. When a pass mode change is encountered (and at the start of diagnostic execution) a message is displayed on the console indicating the pass mode to be executed.

### 3-6 ERROR INFORMATION

When a failure occurs during one of the tests, a message is sent to the console (if present). More information about this is located section V.



!-----+-----!	!-----+-----!
! TEST DESCRIPTIONS	! SECTION IV
!-----+-----!	!-----+-----!

#### 4-1 GENERAL

Many of the tests execute software routines to calculate expected results for each of the operations, and then compare these results against those returned from the FPP and firmware routines.

#### 4-2 BASIC CONTROL TESTS

The Basic Control Tests check the basic interactions between the CPU and the FPP. This is to insure that the ROMs are correctly installed, and that data can be transferred between the CPU and FPP. Additionally, several simple calculations are made to test the FPP, and verify that normal CPU operation has not been impaired. As a result of this testing, certain tests may not be configured in the default test selection if it is discovered that these firmware routines are not present.

#### NOTE

Failure to pass some of the tests in the Basic Control Tests is considered to be fatal, in that correct execution of the other diagnostic tests depends on certain assumptions that are verified in this test. Diagnostic execution is discontinued if errors E000 through E013 of the Basic Control Test occurs. Any attempt to continue execution will result in a trapped halt of 102000 octal (preceded by an error message).

#### 4-3 TST00

TST00 verifies correct execution of floating point to single integer conversions, for 2-, 3-, 4-, and 5-word inputs, including overflow detection.

#### 4-4 TST01

TST01 verifies correct execution of floating point to double integer conversions, for 2-, 3-, 4-, and 5-word inputs, including overflow detection.

#### 4-5 TST02

TST02 verifies correct execution of single integer to floating point conversions, for 2-, 3-, 4-, and 5-word results.

#### 4-6 TST03

TST03 verifies correct execution of double integer to floating point conversions, for 2-, 3-, 4-, and 5-word results.

#### 4-7 TST04

TST04 verifies correct execution of 2-, 3-, 4-, and 5-word floating point add instructions, including overflow and underflow detection for each word size.

#### 4-8 TST05

TST05 verifies correct execution of 2-, 3-, 4-, and 5-word floating point subtract instructions, including overflow and underflow detection for each word size.

#### 4-9 TST06

TST06 verifies correct execution of 2-, 3-, 4-, and 5-word floating point multiply instructions, including overflow and underflow detection.

#### 4-10 TST07

TST07 verifies correct execution of 2-, 3-, 4-, and 5-word floating point divide instructions, including overflow and underflow detection.

#### 4-11 TST08

TST08 verifies correct operation of the accumulator functions of the FPP. Tests involving all operations and legal word types are performed.

#### 4-12 TST09

TST09 tests the SIS firmware for correct operation of the TAN, ALOG, ATAN, COS, SIN, and ALOGT routines. Tests are made to verify the correctness of answers and error returns.

#### 4-13 TST10

TST10 tests the SIS firmware routines SQRT, EXP, and TANH for correctness of answers and error returns.

#### 4-14 TST11

TST11 tests the SIS firmware routines DPOLY, /CMTR, /ATLG, .FPWR, and .TPWR for correctness of answers and error returns. These routines are not present in all revisions of firmware. This test will not be included in the standard configuration if it is determined during the Basic Control tests that these routines are not present.

#### 4-15 TST12

TST12 tests the FFP firmware routines DBLE, SNGL, ..DCM, .PWR2, .FLUN, .PACK, .XPACK, .XCOM, and DDINT for correctness of answers and error returns.

#### 4-16 TST13

TST13 tests the FFP firmware routines .DFER, .XFER, .CFER, .ENTR, .ENTP, .SETP, .GOTO, and ..MAP for correctness of answers and error returns.

#### 4-17 TST14

TST14 tests the FFP firmware routines .DAD, .DSB, .DMP, .DD1, .DSBR, .DDIR, .DIN, .DDE, .DIS, .DDS, .DNG, .DCO, .BLE, .NGL, ..FCM, and ..TCM for correctness of answers and error returns. These routines are not present in all revisions of firmware. This test is not included in the standard configuration if it is determined during the Basic Control Tests that these routines are not present.

!-----+-----!	!-----+-----!
! DIAGNOSTIC MESSAGES AND HALT CODES	! SECTION V
!-----+-----!	!-----+-----!

The diagnostic communicates to the operator through the console, via a CPU halt, or both, based on configuration and S-register execution options.

Table 5-1 summarizes the halt codes and their meanings.

Table 5-2 lists the information messages that may be output by the diagnostic.

Table 5-3 lists the error messages that may be output by the diagnostic.

## 5-1 ERROR FORMATS

All of the tests except the Basic Control Test and TST13 use the same format for reporting errors. This format is shown below. The exact form may vary depending on the function being tested. The formats for errors in the Basic Control Test and TST13 are included in Table 5-2.

EXXX	XXXX	X	WD					
1ST OPERAND	XXXXXX	XXXXXX	XXXXXX	XXXXXX	OVF=X	EXT=X	IND=X	
2ND OPERAND	XXXXXX	XXXXXX	XXXXXX	XXXXXX				
EXPECTED ANSWER	XXXXXX	XXXXXX	XXXXXX	XXXXXX	OVF=X	EXT=X	RTN=X	
ACTUAL RESULT	XXXXXX	XXXXXX	XXXXXX	XXXXXX	OVF=X	EXT=X	RTN=X	

## 5-2 ABNORMAL ERRORS

Error halts 106075 and 106077 octal should not be encountered under normal operation. A halt 106075 octal indicates a transfer of control to an unused area of memory, which may be the result of a hardware or firmware problem. If a trap cell halt (106077 octal) occurs, the cause of the interrupt should be determined. This halt may also be caused by defective hardware or firmware. In either case, the program may need to be reloaded before continuing.

Table 5-1. Halt Code Summary

Halt Code (octal)	Meaning
102000-102017	Basic Test error message.
102020-102065	TST13 error message.
102073	Configuration error, invalid select code input for I/O card.
102074	Successful configuration, input execution options in the S-register.
102075	Operator halt by setting bit 9 of the S-register. Input execution options in the in the S-register, and tests to be executed in the A-register.
102076	Successful completion of test. A-register contains octal value of test just executed.
102077	Successful completion of diagnostic.
103000-103013	TST04 error messages.
103014-103027	TST05 error messages.
103030-103043	TST06 error messages.
103044-103057	TST07 error messages.
106001-106013	TST00 error messages.
106014-106027	TST01 error messages.
106030-106043	TST02 error messages.
106044-106057	TST03 error messages
106071-106076	Refer to Configurator Manual.
106077	Trap cell halt in location 2-77
107000-107007	TST08 error messages.
107010-107015	TST09 error messages.
107016-107020	TST10 error messages.
107021-107025	TST11 error messages.
107030-107047	TST12 error messages.
107050-107067	TST14 error messages.

Table 5-2. Information messages

! Test !	! Message !	! Comment !
! -- !	! FPP-SIS-FFP DIAGNOSTIC ! DSN XXXXXX !	! Diagnostic header message. !
! BC !	! BEGIN BASIC CONTROL TEST !	! Message printed before ! Basic Control Test ! execution. !
! BC !	! OVFL TEST !	! 1st subtest. !
! BC !	! CONF TEST !	! 2nd subtest. !
! BC !	! NOTE: TST11 NOT CONFIGURED !	! Only if SIS firmware ! does not contain these ! functions. !
! BC !	! NOTE: TST14 NOT CONFIGURED !	! Only if FFP firmware ! does not contain these ! functions. !
! !	! !	! -or- !
! !	! !	! If base set is incompat- ! ible with the installed ! FFP firmware. !
! BC !	! BASE RETN TEST !	! 3rd subtest. !
! BC !	! SIS1 RETN TEST !	! 4th subtest. !
! BC !	! SIS2 RETN TEST !	! 5th subtest. !
! BC !	! SIS3 RETN TEST !	! 6th subtest. !
! BC !	! FFP1 RETN TEST !	! 7th subtest. !
! BC !	! FFP2 RETN TEST !	! 8th subtest. !
! BC !	! FFP3 RETN TEST !	! 9th subtest. !
! BC !	! END BASIC CONTROL TEST !	! Ending message for ! Basic Control Test. !
+-----CONTINUED-----+		

Table 5-2. Information Messages (continued)

! Test !	Message	Comment
! 00 !	! FIXS TEST	! \
! 01 !	! FIXD TEST	! !
! 02 !	! FLTS TEST	! !
! 03 !	! FLTD TEST	! !
! 04 !	! ADD TEST	! !
! 05 !	! SUB TEST	! !
! 06 !	! MPY TEST	! \
! 07 !	! DIV TEST	! > Test header message.
! 08 !	! ACC TEST	! /
! 09 !	! SIS1 TEST	! !
! 10 !	! SIS2 TEST	! !
! 11 !	! SIS3 TEST	! !
! 12 !	! FFP1 TEST	! !
! 13 !	! FFP2 TEST	! !
! 14 !	! FFP3 TEST	! /



Table 5-3. Error Messages and Halts

Halt	Test	Message	Comment
*102000	BC	E000 FATAL ERROR	Attempted continuation after fatal error. The previous error indicates that other tests will not execute properly.
*102001	BC	E001 OVFL SET AFTER CLEAR	CPU overflow flag remains set after being cleared. Check cables, FPP, and CPU.
*102002	BC	E002 BASE PRETEST ERROR	Check cables, FPP, and ROMs. Execute FPP selftest**.
*102003	BC	E003 SIS PRETEST ERROR	Check cables, FPP, and ROMs. Execute SIS selftest**.
*102004	BC	E004 FFP PRETEST ERROR	Check ROMs. Execute FFP selftest**.
*102005	BC	E005 2 WD ADD RETURN ERROR	\ Firmware return > error. Check / Base Set and FFP ROMs.
*102005	BC	E005 3 WD ADD RETURN ERROR	
*102005	BC	E005 4 WD ADD RETURN ERROR	
*102005	BC	E005 5 WD ADD RETURN ERROR	
*102005	BC	E005 2 WD FIXS RETURN ERROR	
*102005	BC	E005 2 WD FIXD RETURN ERROR	
*102005	BC	E005 2 WD FLTS RETURN ERROR	
*102005	BC	E005 2 WD FLTD RETURN ERROR	
*102005	BC	E005 3 WD FIXS RETURN ERROR	
*102005	BC	E005 3 WD FIXD RETURN ERROR	
*102005	BC	E005 3 WD FLTS RETURN ERROR	
*102005	BC	E005 3 WD FLTD RETURN ERROR	
*102005	BC	E005 4 WD FIXS RETURN ERROR	
*102005	BC	E005 4 WD FIXD RETURN ERROR	
*102005	BC	E005 5 WD FLTS RETURN ERROR	
*102005	BC	E005 5 WD FLTD RETURN ERROR	

-----CONTINUED-----

\* indicates an error that is considered fatal.

\*\* refer to the F-Series Operating and Reference Manual

Table 5-3. Error Messages and Halts (continued)

Halt	Test	Message	Comment
*102006	BC	E006 SIS TAN RETURN ERROR!	\
*102006	BC	E006 SIS ALOG RETURN ERROR!	!
*102006	BC	E006 SIS ATAN RETURN ERROR!	!
*102006	BC	E006 SIS COS RETURN ERROR!	!
*102006	BC	E006 SIS SIN RETURN ERROR!	!
*102006	BC	E006 SIS ALOGT RETURN ERROR!	\
*102007	BC	E007 SIS SQRT RETURN ERROR!	> Check BASE SET
*102007	BC	E007 SIS EXP RETURN ERROR!	/ and SIS ROMs.
*102007	BC	E007 SIS TANH RETURN ERROR!	!
*102010	BC	E010 SIS CMRT RETURN ERROR!	!
*102010	BC	E010 SIS ATLG RETURN ERROR!	!
*102010	BC	E010 SIS .FPWR RETURN ERROR!	!
*102010	BC	E010 SIS .TPWR RETURN ERROR!	/
*102011	BC	E011 FFP DBLE RETURN ERROR!	\
*102011	BC	E011 FFP SNGL RETURN ERROR!	!
*102011	BC	E011 FFP ..DCM RETURN ERROR!	!
*102011	BC	E011 FFP .PWR2 RETURN ERROR!	!
*102011	BC	E011 FFP .FLUN RETURN ERROR!	!
*102011	BC	E011 FFP .PACK RETURN ERROR!	!
*102011	BC	E011 FFP .XPAK RETURN ERROR!	!
*102011	BC	E011 FFP .XCOM RETURN ERROR!	!
*102011	BC	E011 FFP DDINT RETURN ERROR!	!
*102012	BC	E012 FFP .DFER RETURN ERROR!	\ FFP return error.
*102012	BC	E012 FFP .XFER RETURN ERROR!	> Check BASE SET and
*102012	BC	E012 FFP .CFER RETURN ERROR!	/ FFP ROMs.
*102013	BC	E013 FFP .DAD RETURN ERROR!	!
*102013	BC	E013 FFP .DSB RETURN ERROR!	!
*102013	BC	E013 FFP .DMP RETURN ERROR!	!
*102013	BC	E013 FFP .DDI RETURN ERROR!	!
*102013	BC	E013 FFP .DSBR RETURN ERROR!	!
*102013	BC	E013 FFP .DDIR RETURN ERROR!	!
*102013	BC	E013 FFP .DIN RETURN ERROR!	!
*102013	BC	E013 FFP .DDE RETURN ERROR!	!
*102013	BC	E013 FFP .DIS RETURN ERROR!	!
*102013	BC	E013 FFP .DDS RETURN ERROR!	!
*102013	BC	E013 FFP .DNG RETURN ERROR!	!
*102013	BC	E013 FFP .DCO RETURN ERROR!	!
*102013	BC	E013 FFP .BLE RETURN ERROR!	!
*102013	BC	E013 FFP .NGL RETURN ERROR!	!
*102013	BC	E013 FFP ..FCM RETURN ERROR!	!
*102013	BC	E013 FFP ..TCM RETURN ERROR!	/

CONTINUED

\* indicates an error that is considered fatal.

Table 5-3. Error Messages and Halts (continued)

Halt	Test	Message
102020	13	E020 .DFER FAILED
102021	13	E021 .DFER NO CHECK ON MEM PROT VIOLATION
102022	13	E022 .XFER FAILED
102023	13	E023 .XFER NO CHECK ON MEM PROT VIOLATION
102024	13	E024 .CFER DATA ERROR
102030	13	E030 .CFER FAILED FOR INDIRECT ADDRESSING
102031	13	E031 .GOTO FAILED FOR J=0
102032	13	E032 .GOTO FAILED FOR J=NEG
102033	13	E033 .GOTO FAILED FOR J>16
102034	13	E034 .GOTO FAILED FOR J=8
102040	13	E040 .ENTR FAILED FOR ACTUAL NR OF PARAM. < ALLOWED NR
102041	13	E041 .ENTR FAILED FOR ACTUAL NR OF PARAM. = ALLOWED NR
102042	13	E042 .ENTR FAILED FOR ACTUAL NR OF PARAM. > ALLOWED NR
102043	13	E043 .ENTR NO CHECK ON MEM PROT VIOLATION
102044	13	E044 .ENTR RETURN ADDRESS NOT STORED IN CORRECT LOCATION
102045	13	E045 .ENTR RETURN ADDR. NOT IN A-REG
102046	13	E046 .ENTR INCORRECT ADDR. IN B-REG
102047	13	E047 .ENTP FAILED FOR ACTUAL NR OF PARAM. < ALLOWED NR
102050	13	E050 .SETP A-REG. NOT=0 UPON RETURN
102051	13	E051 .SETP B-REG. DOES NOT CONTAIN LAST ADDRESS+1 UPON RETURN
102052	13	E052 .SETP INCORRECT VALUE STORED
102053	13	E053 .SETP MORE LOCATIONS FILLED THAN REQUESTED
102054	13	E054 .SETP NO CHECK ON MEM PROT VIOLATION
102055	13	E055 .SETP NOT INTERRUPTIBLE
102056	13	E056 .SETP P-REG NOT REST. ON INTERR
102057	13	E057 .SETP A-REG NOT REST. ON INTERR
102060	13	E060 .SETP B-REG NOT REST. ON INTERR
102061	13	E061 .SETP NOT INTERRUPTIBLE DURING PARAM. FETCH
102061	13	E062 .SETP P-REG NOT RESTORED ON INTERR. DURING PARAM. FETCH
102063	13	E063 .SETP A-REG NOT RESTORED ON INTERR. DURING PARAM. FETCH
102064	13	E064 .SETP B-REG NOT RESTORED ON INTERR. DURING FETCH
102065	13	E065 ..MAP DATA ERROR ACT xxxxx EXP xxxxx

-CONTINUED-

Table 5-3. Error Messages and Halts (continued)

Halt	Test	Message	Comment
106001	00	E100 FIXS 2 WD	\
106001	00	E101 FIXS 3 WD	!
106002	00	E102 FIXS 4 WD	!
106003	00	E103 FIXS 5 WD	!
106004	00	E104 FIXS 2 WD	\ Floating point
106005	00	E105 FIXS 3 WD	> to double integer
106006	00	E106 FIXS 4 WD	/ conversion error.
106007	00	E107 FIXS 5 WD	!
106010	00	E110 FIXS 2 WD	!
106011	00	E111 FIXS 3 WD	!
106012	00	E112 FIXS 4 WD	!
106013	00	E113 FIXS 5 WD	/
106014	01	E114 FIXD 2 WD	\
106015	01	E115 FIXD 3 WD	!
106016	01	E116 FIXD 4 WD	!
106017	01	E117 FIXD 5 WD	!
106020	01	E120 FIXD 2 WD	\ Floating Point to
106021	01	E121 FIXD 3 WD	> Double Integer
106022	01	E122 FIXD 4 WD	/ Conversion Error.
106023	01	E123 FIXD 5 WD	!
106024	01	E124 FIXD 2 WD	!
106025	01	E125 FIXD 3 WD	!
106026	01	E126 FIXD 4 WD	!
106027	01	E127 FIXD 5 WD	/
106030	02	E130 FLTS 2 WD	\
106031	02	E131 FLTS 3 WD	!
106032	02	E132 FLTS 4 WD	!
106033	02	E133 FLTS 5 WD	!
106034	02	E134 FLTS 2 WD	\ Single Integer to
106035	02	E135 FLTS 3 WD	> Floating Point
106036	02	E136 FLTS 4 WD	/ Conversion error.
106037	02	E137 FLTS 5 WD	!
106040	02	E140 FLTS 2 WD	!
106041	02	E141 FLTS 3 WD	!
106042	02	E142 FLTS 4 WD	!
106043	02	E143 FLTS 5 WD	/
CONTINUED			

Table 5-3. Error Messages and Halts (continued)

Halt	Test	Message	Comment
106044	03	E144 FLTD 2 WD	\
106045	03	E145 FLTD 3 WD	!
106046	03	E146 FLTD 4 WD	!
106047	03	E147 FLTD 5 WD	!
106050	03	E150 FLTD 2 WD	\ Double Integer to
106051	03	E151 FLTD 3 WD	> Floating Point
106052	03	E152 FLTD 4 WD	/ Conversion Error.
106053	03	E153 FLTD 5 WD	!
106054	03	E154 FLTD 2 WD	!
106055	03	E155 FLTD 3 WD	!
106056	03	E156 FLTD 4 WD	!
106057	03	E157 FLTD 5 WD	/
103000	04	E200 ADD 2 WD	\
103001	04	E201 ADD 3 WD	!
103002	04	E202 ADD 4 WD	!
103003	04	E203 ADD 5 WD	!
103004	04	E204 ADD 2 WD	\ Floating Point
103005	04	E205 ADD 3 WD	> Add Error.
103006	04	E206 ADD 4 WD	/
103007	04	E207 ADD 5 WD	!
103010	04	E210 ADD 2 WD	!
103011	04	E211 ADD 3 WD	!
103012	04	E212 ADD 4 WD	!
103013	04	E213 ADD 5 WD	/
103014	05	E214 SUB 2 WD	\
103015	05	E215 SUB 3 WD	!
103016	05	E216 SUB 4 WD	!
103017	05	E217 SUB 5 WD	!
103020	05	E220 SUB 2 WD	\ Floating Point
103021	05	E221 SUB 3 WD	> Subtract Error
103022	05	E222 SUB 4 WD	/
103023	05	E223 SUB 5 WD	!
103024	05	E224 SUB 2 WD	!
103025	05	E225 SUB 3 WD	!
103026	05	E226 SUB 4 WD	!
103027	05	E227 SUB 5 WD	/
CONTINUED			

Table 5-3. Error Messages and Halts (continued)

Halt	Test	Message					Comment
103030	06	E230	MPY	2	WD	\	
103031	06	E231	MPY	3	WD	!	
103032	06	E232	MPY	4	WD	!	
103033	06	E233	MPY	5	WD	!	
103034	06	E234	MPY	2	WD	\	Floating Point
103035	06	E235	MPY	3	WD	>	Multiply Error
103036	06	E236	MPY	4	WD	/	
103037	06	E237	MPY	5	WD	!	
103040	06	E240	MPY	2	WD	!	
103041	06	E241	MPY	3	WD	!	
103042	06	E242	MPY	4	WD	!	
103043	06	E243	MPY	5	WD	/	
103044	07	E244	DIV	2	WD	\	
103045	07	E245	DIV	3	WD	!	
103046	07	E246	DIV	4	WD	!	
103047	07	E247	DIV	5	WD	!	
103050	07	E250	DIV	2	WD	\	Floatint Point
103051	07	E251	DIV	3	WD	>	Divide Error
103052	07	E252	DIV	4	WD	/	
103053	07	E253	DIV	5	WD	!	
103054	07	E254	DIV	2	WD	!	
103055	07	E255	DIV	3	WD	!	
103056	07	E256	DIV	4	WD	!	
103057	07	E257	DIV	5	WD	/	
107000	08	E300	ACC	2	WD	\	
107001	08	E301	ACC	3	WD	!	Accumulator
107002	08	E302	ACC	4	WD	!	Operation Error
107003	08	E303	ACC	5	WD	/	
107010	09	E310	TAN	2	WD	\	
107011	09	E311	ALOG	2	WD	!	SIS Function Error
107012	09	E312	ATAN	2	WD	!	(part 1), The
107013	09	E313	COS	2	WD	!	majority of these
107014	09	E314	SIN	2	WD	!	routines are in
107015	09	E315	ALGT	2	WD	/	modules 40,41
107016	10	E316	SQRT	2	WD	\	SIS Function Error
107017	10	E317	EXP	2	WD	!	(part 2), majority
107020	10	E320	TANH	2	WD	/	in modules 42,43

CONTINUED

Table 5-3. Error Messages and Halts (continued)

Halt	Test	Message	Comment
107021	11	E321 DPOL 2 WD	\
107022	11	E322 CMRT 4 WD	! ! SIS Function Error
107023	11	E323 ATLG 4 WD	! ! (part 3), majority
107024	11	E324 FPWR 4 WD	! ! in modules 42,43
107025	11	E325 TPWR 4 WD	! /
107030	12	E330 DBLE 3 WD	! \
107031	12	E331 SNGL 3 WD	! !
107032	12	E332 DCM 3 WD	! !
107033	12	E333 PWR2 2 WD	! \ FFP Function Error
107034	12	E334 FLUN 2 WD	! > (part 1)
107035	12	E335 PACK 2 WD	! /
107036	12	E336 XPAK 3 WD	! !
107037	12	E337 XCOM 3 WD	! !
107040	12	E340 DDIN 3 WD	! /
107050	14	E350 DAD 2 WD	! \
107051	14	E351 DSB 2 WD	! !
107052	14	E352 DMP 2 WD	! !
107053	14	E353 DDI 2 WD	! !
107054	14	E354 DSBR 2 WD	! !
107055	14	E355 DDIR 2 WD	! !
107056	14	E356 DIN 2 WD	! \
107057	14	E357 DDE 2 WD	! > FFP Function Error
107060	14	E360 DIS 2 WD	! / (part 3)
107061	14	E361 DDS 2 WD	! !
107062	14	E362 DNG 2 WD	! !
107063	14	E363 DCO 2 WD	! !
107064	14	E364 .BLE 4 WD	! !
107065	14	E365 .NGL 4 WD	! !
107066	14	E366 FCM 2 WD	! !
107067	14	E367 TCM 4 WD	! /